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ABSTRACT

The purpose of this project was to develop a structural model using several important variables related to academic achievement among top college students. Measures of college grade point average (GPA), high school GPA, score on the ACT Assessment, age, and the number of credit hours taken during the college years were collected from graduating seniors for the fall semester of 1994 at a large southern state university. Out of 4,661 graduating seniors, only 1,268 students who completed all the variables were selected for this study. After a series of descriptive statistical analyses and a correlation matrix for included variables, a two-factor solution was obtained from exploratory factor analysis with the PROMAX rotation through the Statistical Analysis System. The first factor was considered an academic factor. The second factor was referred to as a biographical factor. The characteristics and factor loadings of each factor are discussed. The possibility of research to include other relevant variables is also reviewed. (Contains 2 tables and 19 references.) (Author/SLD)

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Latent Structure of Academic Performance

Among College Students

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Abstract

The purpose of this project was to develop a structural model utilizing several important variables related to academic achievement among college students. Measures of college GPA, high school GPA, ACT score, age and the number of credit hours taken during the college years were collected from graduating seniors for the fall semester of 1994 at a large southern state university. Out of 4,661 graduating seniors, only 1,268 students who completed all the variables were utilized for this study. After a series of descriptive statistics and a correlation matrix for included variables, a two-factor solution was obtained from an exploratory factor analysis with the PROMAX rotation through SAS. The first factor was considered an academic factor. The second factor was referred to as a biographical factor. The characteristic and factor loadings of each factor were discussed. The possibility for further research to include other relevant variables was also suggested.

Latent Structure of Academic Performance

Among College Students

Academic achievement has been a topic of research for many years. Historically the research has been conducted with the purpose of predicting performance. The most obvious use of this information is the admission criterion for higher education. In early research in the 1970's, emphasis was on identifying factors associated with academic achievement. During this decade, (Aleamoni & Oboler, 1978; Beasley & Sease, 1974; Larson & Scontrino, 1976; Morgan, 1975; Pedrini & Pedrini, 1978; and Thomas, 1979) ACT scores, SAT scores and high school performance were investigated as possible predictors of academic achievement measured by college grade point average (CGPA). Interestingly, researchers in the 80' and 90's (Aldag & Rose, 1983; Baron & Norman, 1992; Feldt & Donahue, 1989; Hamilton, 1990; Heritage, Harper & Harper, 1990; and White, Nylin & Esser, 1985) continued to focus on these same areas and variables.

ACT Composite score has been one of the most thoroughly investigated factors in the area of academic achievement. This test along with the Scholastic Aptitude Test (SAT) has been used by most institutions of higher education in admissions criteria. The research showed that the use of the ACT Composite score had been found to be a helpful factor in predicting academic achievement with several populations. According to Beasley and Sease (1974), ACT score has predictive validity for black students. Similarly, Feldt and Donahue (1989) sampled 155 graduates from a Nursing program. It was concluded that ACT Composite score was the best predictor of nursing grade point average (GPA).

Five hundred and eighty-five graduates in the Department of Vocational Education at the University of Wyoming were examined by Hamilton (1990). ACT Composite was found to be significant in the prediction of GPA at graduation.

Several other researchers (Aleamoni & Oboler, 1978; Halpin, Halpin & Schaer, 1981; Heritage et al., 1990; Morgan, 1975; Pedrini & Pedrini, 1978; and Pettijohn, 1995) have used college student populations and found the ACT Composite score to be a useful addition to a predictive model of college GPA. However, Aldag and Rose (1983) found no significant correlation between ACT score and academic achievement measured by college GPA. This study involved 787 students at a midwestern community college who had been admitted to the nursing department over a 10 year period. Although the sample size is large, this analysis was based only one department and was therefore not likely representative of the college student population.

A second well accepted factor used in the prediction of academic achievement has been high school grade point average (HGPA). This factor has been found in several studies (Hamilton, 1990; White et al., 1985; Wolfe & Johnson, 1995; and Young, 1991) to be significantly correlated with college GPA. Halpin et al.(1981) based their study of prediction on the effectiveness of HGPA. This variable in addition to ACT, SAT and the California Achievement Test (CAT) were included in the prediction of college GPA for 1453 freshmen. The results suggested that HGPA was the single best predictor and that each of the other three variables added to the variance equally. Additionally, Larson and Scontrino (1976) found similar results in a study with HGPA, SAT Mathematics score and

SAT Verbal score. This study included 1457 students who graduated from a small West Coast university from 1966-1973. It was again found that HGPA accounted for the greatest amount of variance in this model for both males and females.

In most studies, (Aleamoni & Oboler, 1978; Baron & Norman, 1992; Beasley & Sease, 1974; Feldhusen & Jarwan, 1995; Halpin et al., 1981; Hamilton, 1990; Hood, 1992; Houston, 1983; Larson & Scontrino, 1976; Pedrini & Pedrini, 1978; Thomas, 1979 and White et al., 1985) college GPA is used as the criterion variable in the prediction of academic performance. However, some researchers have included (Feldt & Donahue, 1989) the National Council license examination for Registered Nurses (NCLEX-RN) scores, and (Aldag & Rose, 1983) the Nursing State Board Exam scores. Still, the majority of research involves some measure of GPA.

The number of credit hours which a student has taken is another interesting factor in the pursuit of academic achievement. This factor, however, has been included in only a few research models. In research conducted by Hood (1992), 409 freshmen who were admitted to a predominately white midwestern state university through the Office of Education Services and Programs were studied. The number of credit hours completed was used in an effort to predict first semester GPA. However, several of the students had enrolled in two-semester-long courses for which no credit was given after the first semester. The absence of a grade for the first semester made the variable ineffective in the predictive model. However, White et al. (1985) conducted a study which looked at number of credit hours taken in high school as a predictive variable for academic success

defined as graduating in four years. Four-hundred freshmen at a commuter-type college were studied. The results suggested that number of courses taken in high school was the best predictor of degree attainment in four years.

A fifth factor worth mention in the search for a model of academic achievement is age of the student. Aldag and Rose (1983) included age in their research. Seven hundred and eighty-seven students were grouped according to age at admission. It was found that significantly more older students initially passed the State Board exam in Nursing. However, age did not significantly account for differences in college GPA. Hamilton (1990) found that the age of the student at graduation did make a significant contribution to the predictive model of academic achievement.

Past research has looked at predictive models which included observable and manifest variables. Through the past few decades there have been no great advances in predicting academic achievement. They have used the same variables and types of variables for years with little new information. The same models have been analyzed with variables added or taken away. The problem with this research is that of measurement error and colinearity. Observed variables do contain measurement error due to many different reasons. Measurement error either clouds or exaggerates the true relationship between variables. Another problem associated with the analysis of observed variables is that of colinearity. Observed variables are correlated and not independent. Like measurement error, it is also possible that colinearity conceals the true relationship among variables. Due to the development of statistical techniques it is now possible to explore the

relationship through latent traits which are reported to be free of measurement error. The purpose of this project was to explore the structure of correlated observed variables involved in academic achievement. The variables included are ACT total score, college GPA, high school GPA, number of credit hours completed, and age of the student during the senior year. These components were chosen based on the past research which gives support to each variable as having predictive potential.

Method

Subjects

Subjects were chosen from archival data at Middle Tennessee State University. These subjects were seniors in the Fall of 1994. Students whose GPA, ACT, HGPA, age and number of credit hours were available were selected for the analysis. Out of 4661 students, 1269 met this criteria. One subject was deleted from the study as an extreme outlier based on the fact that the person's HGPA was .05, therefore the analysis was based on 1268 participants. The subjects ranged in age from 20 to 35 (mean = 22.86). Their ACT Composite scores ranged from 12 to 33 (mean = 21.29), HGPA from 1.27 to 4.0 (mean = 3.06) and CGPA from 1.41 to 4.0 (mean = 2.82). The number of credit hours completed by the subjects ranged from 82 to 219 (mean = 124.68). Any information which could identify the individuals was deleted from the data in order to preserve the subjects' confidentiality.

Results

The correlations matrix as well as the means and standard deviations for CGPA, ACT, H GPA, age and number of credit hours (# credit) are provided in Table 1. The correlations show two clear clusters of variables. The first cluster includes CGPA, ACT and H GPA, whose correlations are all positive and generally high (.45 to .58). The second cluster is that of age and number of credit hours which is also relatively high (.46). The age variable was negatively correlated with all measures of academic performance contrary to expectations. These results lead to the possibility of two factors which may result from the clusters. An exploratory factor analysis revealed two distinct factors. As in the correlation matrix, the first factor was contributed by CGPA, ACT and H GPA. The second factor included age and the number of credit hours. The two factor solution explained 71% of all the variance. The Promax rotation was utilized to obtain a better solution. The factor loadings are reported in Table 2. The inter-factor correlation between the two factors was $-.10$, which is considered marginal. The first factor can be named an academic factor. The second may be considered a demographic factor.

Discussion

This study was explorational in nature. An attempt was made to investigate the underlying structure of commonly used variables related to academic achievement among college students. A two factor solution was rendered through a factor analysis. The significance of this study lies in the application of latent trait analysis to college students' academic performance. Through latent trait analysis, one can easily expand the scope of

this study to discover any true relationship among latent traits related to academic performance variables.

Some cautions should be taken in generalizing the results of this study. The data analyzed came from only one university in the southwest. A second limitation is that of missing data. Out of 4661 seniors, only 1268 were used. The missing data may have contributed to the analysis. Additionally, students entering college after the age of 21 and transfer students are not required to submit ACT scores at Middle Tennessee State University. Therefore, data were unavailable for many of these students. As a result, the present findings may be limited to traditional student populations (i.e., students who entered college as freshmen before the age of 21). This may account for the negative correlation reported between age and academic variables.

Future studies should expand the sample size and make an effort to include non-traditional students. Additional variables may also be selected to further develop the structural model. It can also be suggested that any significant group differences among college students can be investigated to determine the structural fit of the model. Such groupings may include age, gender, year in school and race.

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Table 1

Correlation Matrix and Means and Standard Deviations for CGPA, ACT, HGPA, Age, and # Credit

	CGPA	ACT	HGPA	Age	# Credit
CGPA		.45***	.58***	-.28***	.02
ACT			.50***	-.11***	.11***
HGPA				-.27***	.05
Age					.46***
# Credit					
Mean	2.82	21.29	3.06	22.86	124.68
SD	.51	3.47	.53	1.88	19.82

N = 1268

***: $p < .0001$

Table 2

Factor loadings for CGPA, ACT, HGPA, Age and # Credit

	Factor 1	Factor 2
CGPA	.81	
ACT	.84	
HGPA	.79	
Age		.82
# Credit		.88